



CITY OF LODI COUNCIL COMMUNICATION

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AGENDA TITLE: Approve Request for Proposal (RFP) to Replace and Upgrade the Existing Utility Supervisory Control and Data Acquisition (SCADA) System (EUD)

MEETING DATE: November 7, 2007

PREPARED BY Electric Utility Director

RECOMMENDED ACTION: Approve Request for Proposal (RFP) to replace and upgrade the existing utility Supervisory Control and Data Acquisition (SCADA) System.

BACKGROUND INFORMATION: The existing SCADA System is comprised of two separate systems; one of **1980s** vintage and the other purchased in 2001, and is based on the Siemens' Telegyr platform. It is used by the EUD Dispatch Center to control, monitor and acquire the status, alarms, sequence of events, data and other parameters pertinent to real-time operation of water, wastewater and electric utilities in the City. Remote terminal units (RTU) are installed in each well, pump, storm/lift stations and also to all four electrical distribution substation facilities within the City. The SCADA System's interface with these RTUs is through leased lines provided by the local telephone company.

The first SCADA System was placed in operation in the **1980s** utilizing **two** units to provide necessary redundancy. The first unit has been inoperable for an extended period due to non-availability of parts and the second is plagued with periodic operational problems.

The second SCADA System was purchased in 2001 with the intent of replacing the first SCADA System when fully operational. While the basic SCADA framework and software were configured and integrated by Siemens, the remainder of the system was to be programmed by in-house personnel. Due to a variety of issues, this second SCADA System was never fully implemented and its **hardware/software** is now obsolete.

The City's utility operations are dependent on an adequate, secure and reliable SCADA System. As noted above, the existing SCADA systems are only marginally operational and not fully redundant as is needed for reliability. The proposed system under the RFP will be built with redundant units operating in parallel and will be provided on a "turn-key" basis.

FISCAL IMPACT: Estimated cost is approximately \$125,000.

FUNDING AVAILABLE: Transfer of funds from unencumbered bond proceeds (Electric Utility Department 2002 Certificate of Participation Series A) to Account No. 161052

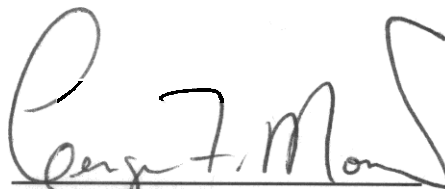

Kirk Evans, Budget Manager

APPROVED: 
Blair King, City Manager

Approve Request for Proposal (RFP) to Replace and Upgrade the Existing Utility Supervisory Control and Data Acquisition (SCADA) System (EUD)

November 7, 2007

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A handwritten signature in black ink, appearing to read "George F. Morrow". The signature is written in a cursive, flowing style with a large initial "G" and a long, sweeping underline.

George F. Morrow
Electric Utility Director

PREPARED BY: Demy Bucaneg, Jr., P.E., Manager, Engineering & Operations

GFM/DB/1st
Attachments



October 23, 2007

Exhibit 1 - Specifications

City of Lodi Electric Utility Department (EUD) SCADA10.07 SPEC

Purpose: It is the expressed purpose of this specification to establish a minimum guideline in which any prospective bidder(s) in association with the City of Lodi should comply with for the engineering, design and building of the whole or any part of the electric utilities SCADA (Supervisory Control and DATA Acquisition) system.

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CHAPTER I - INTRODUCTION

General Overview

This document describes the requirements for the replacement and upgrade of the existing Supervisory Control and Data Acquisition (SCADA) system for the City of Lodi (City). The SCADA System shall be installed in the Electric Utility Department (EUD) Dispatch Center located at 1331 South Ham lane Lodi, California 95242.

All exceptions and/or clarifications shall be clearly identified and shall be referenced to the specific paragraph and/or section of this specification. They shall be submitted as part of the bidder's proposal as indicated in the Request for Proposal (RFP). Minor exceptions between the bidder's proposal and the specification may be allowed, however any major exceptions may be considered non-compliant and be the cause for rejection.

Bidder Requirements

The prospective bidder shall be able to fulfill the following qualification requirements:

- a. Bidder shall state the number of years of experience in the design and manufacture of systems of the type specified;
- b. Bidder shall provide ten (10) customer reference projects with a similar configuration and functionality to the system proposed. The list of reference projects shall include at least the following information: customer name and address, contact name and phone/email, starting date of commercial operation, operating system platform.
- c. Bidder shall utilize standard off-the-shelf hardware and operating system software which are available at least from two different commercial sources;
- d. Bidder shall provide support services with a 24/7 availability;
- e. Bidder shall state whether there are any anticipated changes in ownership or major corporate policy changes in the next 12 months;
- f. Bidder shall state whether there are or there have been any legal claims or litigation actions against him regarding the performance of projects.

Bidder's Responsibilities

The prospective bidder shall be responsible for the following:

- a. As turn-key contract, design, assemble, manufacture, factory test, deliver, install and commission a complete and fully functional replacement and upgrade of the existing SCADA System according to the SCADA RFP and specifications;
- b. Interface with existing and new RTUs and other City's existing and supplied devices;
- c. Work with designated City Staff for the integration, test and commissioning of all special application programs for water and power facilities;
- d. Provide training courses at the City's facilities;
- e. Provide on-site supervision of installation and commissioning of the system;
- f. Provide technical support and assistance during the commercial operation of the system.

City's Responsibilities

The City shall be responsible for the following:

- a. Provide air conditioned environment in the control room;
- b. Provide power sources and communication wiring to the equipment locations;
- c. Technical review of the successful bidder's documentation;

- d. Participate in the factory acceptance testing;
- e. Provide copy of the existing database, if any, in an electronic format for conversion;
- f. Provide programs for special application processes on City's water and power facilities;
- g. Attend the training courses on site;
- h. Provide a project person for the coordination of all project activities with the successful bidder's project manager.

Standards

The bidder shall state the standards which apply in the design and manufacture of the proposed system. The standards shall include but not be limited to the following standards:

- a. ANSI American National Standards Institute
- b. IEEE Institute of Electrical and Electronics Engineers
- c. IEC International Electrical Code
- d. NERC North American Electrical Reliability Council
- e. NEMA National Electrical Manufacturers Association
- f. EPRI Electrical Power Research Institute

Where the proposed standards differ from above, bidder shall state which standard applies. Where non-standard hardware, software or services are offered, bidder shall justify their adequacy and applicability in relation to the functions to be performed.

CHAPTER 2 - SYSTEM CONFIGURATION

Primary Master Station

The master station shall consist of a host computer (SCADA server), with separate operator workstations (SCADA clients), and communication servers (terminal servers), all interconnected by a high-speed local-area network (LAN). The system shall support the TCP/IP protocol which will be used for all data exchanges between the various nodes on the network.

Redundant Master Station

As an option, the master station shall consist of a redundant configuration with dual host computers (SCADA servers), with separate operator workstations (SCADA clients), and terminal servers, all interconnected by a high-speed local area network (LAN). The network shall support the TCP/IP protocol which will be used by the SCADA system for all network communications.

The active host computer shall maintain the standby computer in a fully synchronized state via the network. In the event of a failure of the active machine, the standby computer shall automatically assume control of all peripherals and communication lines with no action required from the system operator.

Optional Quad Redundant Master Station

As an option, the system shall also be able to handle quad redundant configurations, i.e. comprising four (4) servers running in main/hot-standby mode.

Configuration

The host server(s) and all workstations shall consist of standard PC architecture machines utilizing Intel or equivalent processors. Operating system software shall be industry standard, off-the-shelf software. It shall provide a windowing graphical user interface environment.

The SCADA host software and the operator interface software shall run directly in the operating system's own windowing environment. X-Windows sessions or other emulations are not acceptable. A system of pull-down menus and dialog boxes shall provide the operator with quick, intuitive access to normal SCADA operations, as well as to database editing and system configuration functions.

The operator interface shall be graphics based and shall be capable of importing vector graphic data from other mapping systems such as AutoCAD or GIS for incorporation into the SCADA displays. Such imports shall be based on the DWG or DXF file formats. The operator interface software shall include the ability to merge multiple imported maps into one SCADA display and to edit the imported graphics.

For communication with RTUs, IEDs and other serial-data peripheral equipment, commonly available terminal servers shall be provided to off-load serial communication processing from the host computers. The serial data ports provided by the terminal servers shall be capable of two-way serial communications.

User Interface

The operator interface software shall provide a single world coordinates based graphical view of the system, arranged schematically or geographically as defined by the user. It shall be possible to navigate freely in this global map, scrolling in two dimensions (panning) and zooming in or out to view any location at any desired

degree of magnification. The displays shall contain static graphical information, as well as dynamic elements that reflect the information contained in the host computer's database. Database point values displayed by such dynamic elements may be either telemetered from RTUs or calculated by the host server.

Operator interaction with database points shall be by means of clicks of the mouse on the dynamic display elements. This will include operations such as controlling field devices, setting database values, e.g. manual updates, acknowledging or blocking alarms and tagging data points to inhibit control. The user shall be able to use elements on the display as pushbuttons to initiate pre-defined actions. These shall include, as a minimum, the ability to:

- bring up pop-up notes
- bring up trend graphs
- bring up other displays
- bring up Microsoft Excel or Access based reports
- run command sequences
- access records in other databases
- access other displays within the global map

Displays are specific rectangular areas within the global map. The user shall be able to define any number of displays in the global map. The operator shall be able to go to a display by means of either a pushbutton or by selection from a list. To facilitate navigation through the list of displays, it shall be possible to organize the list in a hierarchical set of named folders.

The system shall support an unlimited number of graphical layers which can be de-cluttered either automatically (based on zoom level) or manually by the operator. The system shall also support an unlimited number of displays.

Master-to-RTU Communication

The SCADA system shall support the protocols used by the City's existing and/or proposed/new RTUs. In addition, the system shall have the following open protocols available as options:

- DNP3.0 Level 2
- IEC 870-5-101
- Modbus

These protocols shall be available for both serial and network interfaces (TCP/IP). The above protocols shall be run in native mode, i.e. there shall be no need for an external protocol converter (hardware unit) or internal converter (third party software driver), nor shall there be any need for any kind of front-end processor. The proposed system shall not have any limitation in the number of communication lines whether serial or over TCP/IP. No software upgrades or additional licenses shall be required to increase the number of communication lines for protocols that already run on the system.

The master station database editor shall allow the user to define key parameters for each communication line: baud rate, time allowed for the RTU to respond, the number of retries, accumulator poll interval, interval between scans, and protocol-specific configuration parameters. The communication software shall maintain communication statistics for each RTU. These statistics shall be available as database points so that they can be incorporated in user-defined displays, reports, and alarms.

In cases where the RTU protocol supports exception polling, the communication software shall make use of it to provide rapid alarm throughput and capture of multiple, rapid succession alarms. The communication software shall automatically interleave polls for results from controls between normal round-robin exception polls. Where applicable, all station accumulator freeze-commands shall be used to provide simultaneous system-wide sampling of accumulator points.

Master-to-IED Communication

Intelligent Electronic Devices (IEDs), if included in the system, shall be able to either be polled directly by the host server in the same manner as RTUs, or to be polled by an RTU. In the latter case, IED data gathered by the RTU shall be reported to the Master Station along with the RTU's own data.

The Master Station shall support the communication protocols used by the IEDs connected directly to the Master Station. IEDs that are connected to an RTU that is supplied by the vendor shall be mapped into the RTU's database by means of user defined mapping tables. These tables shall allow any subset of each IED's data to be mapped into RTU's database. The structure of these mapping tables shall support multiple IEDs on each communication port in the RTU. Different IED protocols shall be supported by the RTU on each port.

The mapping tables used by the vendor's RTUs shall be maintainable at the SCADA host server and automatically downloaded to the RTUs by the communication software. The proposed system shall not have any limitation in the number of field devices and IEDs to be connected. No software upgrades or additional licenses shall be required to increase the number of IEDs to be integrated into the system.

System Sizing

The SCADA system hardware shall be equipped for the quantities indicated in the Appendix A. The required capacity for future expansion is also included in the Appendix A. The system software shall be capable of accommodating in its database an unlimited quantity of status and control points, analog input points, text points, communication lines, RTUs, IEDs, operator workstations, reports, graphic symbols. These unlimited capacities may only be limited by the resources of the servers, operating system (memory size) and network. The size of the system map shall be up to a maximum of 1 billion x 1 billion drawing units.

The system shall be able to fully process a continuous alarm throughput of 50 alarms per second for at least 60 seconds. Both the World Coordinate map and the displays on all workstations shall be updated and responsive to controls throughout the alarm burst.

System Maintainability

The system shall be designed such that the user will be able to maintain the SCADA system with minimum reliance on the successful bidder's services. The system shall include all the necessary software for configuration of the system, integration and maintenance of the database. The database maintenance software shall provide a convenient graphical view of the entire database, with easy navigation throughout the database. The database editor shall allow interact with the user in an intuitive manner by means of dialog boxes and other familiar controls that are standard to the operating system. The successful bidder shall provide training courses covering these subject areas.

The successful bidder shall provide with the system, a dial-up diagnostic maintenance modem to provide access for system troubleshooting and software updates. The successful bidder shall have the ability to provide same day diagnostic troubleshooting and database assistance from the vendor's software facilities during normal working hours.

The successful bidder shall provide evidence that:

- The proposed software is owned and controlled by the bidder.
- The proposed system has a low cost of ownership.

- The bidder has full-time designing and programming staff capable of supporting and enhancing the software.
- The bidder maintains a full-time customer service department capable of providing same day diagnostic services via modem or VPN.
- The proposed software has a sizeable installed customer base.
- The bidder maintains an active User's Group organization.

The bidder shall have a formal version release method and shall be able to offer upgrades to newer versions of the proposed system software.

CHAPTER 3 - SYSTEM HARDWARE

Hardware Platform

The hardware platform encompasses all of the physical hardware devices utilized by the SCADA system including host servers, operator workstations (local and remote), storage devices, communication interfaces, printers, GUI devices (LCD Flat Panels) and LANs to which all the hardware devices shall connect.

The system shall be implemented with industry standard general purpose devices and interfaces. The proposed hardware devices shall be available from at least two different commercial sources (brands) on the market. The hardware platform shall be scalable such that existing devices shall be able to be replaced with higher performance/capacity devices with no or minimal impact to the system.

All materials and equipment furnished for permanent installation in the work shall conform to applicable standard specifications and shall be new, unused, and undamaged.

Host Servers

The system supplier shall provide the Master Station server hardware and peripherals built by a leading computer industry manufacturer. The preferred computer manufacturer is Dell. The servers shall be wholly designed, manufactured, warrantee, and assembled by the computer manufacturer. Composite component computer frames assembled with multi-vendor cards by second source manufacturers will not be accepted.

The host servers shall have as a minimum 3.0GHz Intel or equivalent processors with 1GB RAM memory, 80 GB internal disk drive, Read-Write CD-ROM, 40 GB tape backup drive, 10/100baseT Ethernet adapter. One 15-inch color Flat Panel LCD shall be provided with a KVM (keyboard-video-mouse) extender for switching between servers for trouble-shooting purposes. A 56K internal modem or better shall be provided for remote diagnosis by the system supplier via dial-up.

The host servers and associated communication equipment shall be delivered rack-mounted in cabinets with perforated walls for easy ventilation. The host servers shall run the latest MS Windows 2003 Server Edition operating system.

Workstation Consoles

The system supplier shall provide workstation console hardware and peripherals built by a leading computer industry manufacturer. The computer manufacturer shall be the same as for the host servers. The proposed workstation shall have as a minimum 3.0 GHz Intel or equivalent processor with 512MB RAM memory, 40 GB internal disk drive, Read-Write CD-ROM, 10/100baseT Ethernet adapter, one (or two, or more) 20-inch Flat Panel LCD with graphic adapter with a minimum resolution of 1280 x 1024 pixels, wireless keyboard and mouse.

The workstations shall run the latest MS Windows XP Professional operating system. The system shall be able to support any number of workstation consoles without any need for upgrading the system hardware and software.

Remote Consoles

As an option, the proposed system shall be provided with remote consoles which are based on laptop (notebook) computers.

The remote consoles shall use a dialup modem integral to the laptop to call the master station. As an option, the remote consoles shall use a communication wide area network (WAN) or a virtual private network (VPN) for accessing the host server. All functions and features in the local GUI shall also be accessible from the remote consoles.

Communication Interfaces

The communication servers shall provide the interfaces between the Master Station and the RTUs and/or IEDs in the field. The vendor shall propose industry standard, off-the-shelf terminal servers which shall support both standard asynchronous serial interfaces and TCP/IP interfaces. Each communication port on the terminal server shall be able to be used either as a serial RS232 port or as a network TCP/IP port, at user's choice. When external modems are required, a Bell 202D modem shall be configured for each channel.

The terminal servers shall be provided in dual redundant configurations, in the case of a dual redundant Master Station. In this case, each terminal server shall be connected to a Local Area Network (LAN) in a dual redundant LAN configuration. The terminal servers shall be modular and easily expandable in modules of eight or sixteen ports. This interface approach shall support communication via phone leased lines, microwave, radio, optical fiber, satellite and other methods of telecommunication.

Peripherals

The system shall be provided with a logger which shall be a 300 cps dot matrix printer for logging purposes. The system shall also be provided with a laser or inkjet printer that will produce high quality graphical printouts of the system screens at 1200 dpi with speeds up to 11 ppm in color. The printer shall support a parallel or Ethernet network interface.

CHAPTER 4 - SYSTEM SOFTWARE

Compliance with Open System Standards

The proposed SCADA system shall have been designed for openness. The Master Station shall have been designed around off-the-shelf industry standard software to provide open access across any TCP/IP based networks.

The following industry standards shall be part of the foundation of the proposed system:

- a. MS Windows Operating System. The Windows version running on the host servers shall be Windows server edition whereas the version running on the workstation consoles shall be Windows XP Professional. Hybrid or multiple operating systems such as a combination of MS Windows with OpenVMS, UNIX or LINUX will not be acceptable.
- b. MS SQL Server Relational Database. An off-the-shelf package designed for storing data, sorting information, retrieving data in custom reports and providing an industry standard interface to other applications shall be used.
- c. Interfacing to AutoCAD and/or GIS or AM/FM systems using DXF or DWG graphic industry standards.
- d. ODBC (Open Database Connectivity) standard which is supported by Microsoft, Oracle, Novell and many others, and creates a common relational database and SQL structure for interoperability between different applications.
- e. TCP/IP – inter-process communications standard which provides a standard protocol for LAN/WAN communications and a standard language for Client/Server applications.
- f. DNP3.0 Level 2 as a standard communication protocol for RTUs and IEDs adopted by the utility industry in North America.
- g. OPC (Microsoft Ole for Process Control) – as a standard for integrating applications for industrial systems such as: water, gas, etc, used in the vertical utilities.

Operating System

The system shall use a true multi-user, multi-tasking operating system platform as provided by Microsoft Windows. The operating system shall exhibit robust security features, shall support resource accounting at both the user and application level, shall support Microsoft Windows without emulation as well as DOS, shall support 32-bit processing and be memory addressable to 2 GB.

The system platform shall be scalable including the capability for a distributed architecture with multiple distributed peer workstations, performing concurrent task processing, supporting engineering, management and development activities at various sites. The system shall be provided with adequate tools and utilities to monitor the performances and to manage the resources of all subsystems.

Database Structure

The database structure shall be specifically designed for high performance real-time operation. A proprietary hierarchical database will be acceptable for reasons of providing high performance and fast response times.

The real-time database shall be accessible via ODBC interfaces to import and export data from the SCADA database to standard commercial applications such as Microsoft Excel or Access.

On-line database editing capability for adding, replacing or deleting points in the database, RTUs, communication lines, etc, shall be possible without any interference to the system operation.

A user-friendly graphic editor shall be provided for building of new global maps and displays and for editing existing ones through interactive and intuitive methods.

Access to capabilities of editing both the database and displays shall be available at all operator and engineering workstation consoles; however it shall be restricted only to users with appropriate rights and privileges.

The system database size shall be able to be expanded to handle additional points without any need to expand the hardware, perform any software change, or pay additional licenses.

Historical Database

The historical database shall be able to store any data from the real-time database on a periodic or snapshot basis definable by the user. The historical information subsystem shall be able to provide storage of unlimited quantities of historical data depending only on the limitation of hardware resources (disk storage, etc). The stored historical data shall be accessible to other applications for data review and analysis and to trending displays.

The underlying platform of the historical information subsystem shall be a commercial, industry standard RDBMS (Relational Database Management System) such as: MS SQL Server, Oracle, and Sybase. The preferred RDBMS platform for this project is MS SQL Server.

CHAPTER 5 - SYSTEM FUNCTIONAL REQUIREMENTS

Data Acquisition

The proposed system shall be able to provide the following data acquisition functions:

- a. Monitor analog values such as Volts, Amps, Watts and VARs at each substation. Convert these values to a digital format. Transmit changed values back to the Master Station. Convert these values into engineering units. Display these values on single line diagrams and provide alarm limit checking. Provide historical storage at user definable interval and retention periods.
- b. Monitor the status changes of various switch contacts and other equipment in the field. Provide an audible and visual alarm when the switches have changed status without being commanded.
- c. Accumulate kilowatt-hour pulses from pulse initiators at each substation. Provide a freeze of counts by RTU on a user definable interval. Transmit the counts back to the Master Station. Convert the counts into interval and hourly deltas. Provide historical storage at a user definable interval and retention period.

Supervisory Control

The proposed system shall be able to provide the following supervisory control functions:

- i. Allow the system operator at the Master Station to issue controls to trip and close breakers through a select-before-operate sequence and automatically monitor breaker auxiliary contacts to ensure operation,
- ii. Allow the operator to manually control load tap changers and monitor the tap position,
- iii. Allow the operator to manually control the circuit breakers.
- iv. Allow the operator to provide output pulses to generator units. The system shall be able to download both a variable number of pulses and a variable length pulse.
- v. Allow the operator to run a switching order sequence which allows the user to define various automatic controls that occur under predefined conditions.

RTU Communication

The bidders shall list the available and proposed protocols that the proposed master station can support. As a minimum, in addition to the protocols required for existing or proposed RTUs and IEDs, the master station shall also have available, as options, such open protocols as DNP3.0, IEC 870-5-101 and Modbus for both serial RS232 and IP-based network communication.

The software subsystem for the proposed protocols shall implement all features of the RTUs and IEDs that are required by the City of Lodi. As a minimum, the following functions shall be included:

- a. Rapid polling of RTUs for exceptions
- b. Select-before-operate control execution
- c. Variable control durations for momentary controls

- d. Detect and report multiple changes of state between poll cycles , if the RTU does not buffer changes but instead reports a “multiple change detect” bit
- e. Automatic interleaving of multiple priority messages, e.g. automatic “fast scan” after a control and “error scan” after a communication error
- f. Scheduled accumulator freezes and polls
- g. Scheduled integrity (general interrogation) polls
- h. Time synchronization of the RTUs
- i. Sequence of events data uploading and processing

When a user-definable error retry count expires for an RTU, the system shall declare the RTU failed by means of a status point and an accompanying alarm. On RTU failure, the system shall mark all points that are telemetered by the RTU as “telemetry failed”. For each point, this telemetry failed quality code shall not clear until a value is subsequently received from the point.

The user shall be able to define alternate communication ports (or IP addresses) that can be used to reach the RTUs. On a series of communication errors with an RTU, the system shall switch ports after a user-definable port retry count expires. A separate port status point for each RTU shall be maintained to indicate which port is currently being used to poll each RTU. If the communication line is looped, it shall be possible to determine between which two RTUs a break exists by examining the values of the port status points.

By manually setting the value of a port status point, it shall be possible for the user to force the system to use only one port for the associated RTU. By manually setting the value of an RTU's status point, it shall be possible for the user to shut down polling of that RTU. For each RTU, the system shall maintain communication statistics in the form of analog points that may be viewed on displays, printed in reports, or stored in historical data files. Such statistics shall include percentage of successful communication, number of timeouts and number of security errors.

After an RTU has been declared failed, the system shall continue to poll it but at a reduced rate, for example: poll only one failed RTU on each round-robin poll cycle. If all RTUs are failed on a communication line (on both ports, if two ports are defined), the system shall declare the entire communication line as failed.

Each communication protocol software module shall support a communication monitoring facility that allows the user to view the messages issued to and returned from the RTUs. The operator shall be able to monitor individual RTUs or all RTUs.

Status Data Processing

The system shall be able to acquire process and display status points (single and multi-bit). Each status point may have a control point associated with it. A control command shall initiate a timer to check if the back-indication is received within a certain time period from the initiation of the control command and if not, an alarm shall be generated. If a change of status is detected which is not the result of a control command, an alarm shall be generated.

The system shall be able to process the following types of status changes:

- a. 2-state status. This type of input shall be used to indicate the status of a device that may be in one of two possible states. The user shall be able to define the names of each state, e.g. ON and OFF, Open and Closed. In addition, a color shall be associated with each state such that a normal state could be green while abnormal could be red.

- b. 3-state status. These inputs are similar to the 2-state status points except that the device may take on any of three possible states. The user shall be able to define the names and colors associated with each state, e.g. Open, Closed and In-transit, or Illegal.
- c. Multiple State Change. This feature shall provide support for multiple status changes that result from control commands. For each control point, it shall be possible to specify a list of up to 30 status points that may change as a result of a command. If not all the expected transitions occur within the control point response time-out, the system shall generate an alarm for the control point as well as an additional alarm for each associated point that did not undergo the expected transitions.

Analog Data Processing

The system shall scan every analog input in the RTUs at predefined scanning intervals. Any failure to complete a scan shall be marked with a data quality flag. Also the system shall scan each analog input every second and compare that input to the previously reported input. When the difference between these values exceeds its reporting band, the analog value shall be reported (report-by-exception).

The master station shall convert each scanned analog point to engineering units whereby both the telemetered and converted data shall be stored in the database. The user shall be able to specify the scale factor and offset to represent the conversion factors for a linear conversion of the telemetered input values to engineering units.

The system shall be capable of checking the analog values for at least three sets of limits: warning, emergency and reasonability. Each of these three sets of limits shall be provided with an upper limit, a lower limit and a deadband. The deadband associated with each limit is used to prevent multiple alarms from being generated when the value hovers near a limit value.

To allow the removal of noise readings around the zero mark of the engineering scale, a range of engineering values inside the point value range shall be specified which shall clamp the input value to zero. For example, if the zero-clamp deadband is 3.0, any input value which is converted to between +3.0 and -3.0 engineering units will be clamped to zero.

The system shall provide a rate-of-change for analog input values by computing the difference between the new and previous value and dividing this by the difference between the current time and the time the point was last updated. The rate-of-change shall be checked against the limits for rate-of-change.

Pulse Accumulator Data Processing

The system shall be able to process accumulators received from the RTUs. The system shall send a command to freeze the accumulators either to all RTUs or to selected RTUs. However this freeze command shall not reset the accumulators in the individual RTUs. Upon receiving the accumulator readings at the master station, the system shall automatically calculate the difference from the last reading.

The system shall retrieve the hourly accumulators every hour from the RTUs and shall convert them to engineering units. The system shall also be able to retrieve accumulators at user-definable intervals from 15 to 30 minute intervals.

Sequence of Events Data Processing

The system shall be capable of processing digital indications from the RTUs which are tagged with the time of event occurrence (SOEs) provided that the RTU protocol supports this feature. The Master Station shall perform a time synchronization of all the RTUs which are equipped with SOEs. The system shall provide a separate SOE Summary List with the chronologically or reverse chronologically sorted SOEs.

Control Output Requirements

The system shall perform all control operations to field devices in a safe secure manner. The operator shall be promptly informed if any anomalies occur during the control sequence. There shall be the following types of controls available in the system: control & indication, raise/lower control, analog output control, pulse output control.

The control & indication type shall be used for controlling the status of breakers, recloser circuits, ground circuits, line switches and similar devices. This type of control shall be able to accommodate either a single sending contact (two-state control & indication) or two sensing contacts (three- or four-state control & indication) per point. The raise/lower controls shall be used for controlling tap changes, control valves and similar devices. The analog output control shall be used for providing setpoints to local controllers (generation controllers, pressure controllers, flow controllers, etc). The pulse output controls shall be used for generator control and shall be provided with either variable duration pulse or a train of pulses.

Where supported by the RTU protocol, the system shall utilize a Select-Checkback-Execute technique that requires secure handshaking with the RTU before any controls are executed. In such cases, control of a point requires the following exchange of messages:

- Master to RTU - control point selection
- RTU to Master - point address check-back
- Master to RTU - control execution
- RTU to Master - execute acknowledgement

If the Master Station does not receive proper acknowledgement of either the select request or the execute command, a check-back failure alarm shall be generated by the system. If the acknowledgements are correct, but the expected status change does not occur within the point's control response timeout, a control failure alarm shall be generated. An optional multiple status change validation feature shall be available to handle cases where a control causes multiple status changes to occur.

Areas of Responsibility

The SCADA software shall be able to be partitioned into 128 areas (or zones) of responsibility. The user shall have the ability to assign any combination of the 128 zones to each database point (telemetered or calculated) and/or to each login account. Examples of how zones may be used to partition the system are into separate utilities, if the system is a combined electric, gas and water system, or into high voltage and low voltage circuits, if the system is an electric distribution network and operators have different license requirements for different voltage levels.

The user shall be able to create any number of zone groups containing various combinations of the 128 zones and to give each zone group a name. In addition, each user account shall specify the types of activity that are permitted for that user. These individual user privileges must be individually enabled or disabled and should consist of such activities as point editing, report editing, alarm acknowledgement and blocking, manual set and control, and tagging. An operator shall be able to manipulate only those points whose zones overlap those of his login account.

Tag Management

When a controlled device or a line fed by a controlled device requires maintenance, it is required that the system provide a facility for limiting control of that device. The system shall allow operators to inhibit control of devices

by means of a secure, multi-level tagging feature. This feature shall allow operators to apply up to eight tags to each point, each tag being stored with a date/time stamp and optional operator-entered description. Each point shall be able to be provided with a visual attribute showing that the point has one or more tags on each display where that point is shown.). It shall be possible to create tables of symbols that are to be displayed on tagged points. If a point is tagged, the display shall show the symbol that corresponds to the highest-level tag on the point.

The system shall provide the capability to configure a custom set of tag types that are mapped to the following four basic types of tags: Inhibit ON and OFF controls, Inhibit ON control only, Inhibit OFF control only, Information only (no control inhibit). The system shall permit no means of bypassing the control inhibit caused by a tag. This applies to any and every application supplied by the vendor or written by the City of Lodi using the vendor's API.

A group tag function shall be provided that allows an operator to define a tag, select multiple points and apply the same tag to all selected points.

Calculations

The system shall include a periodic calculations program that allows the user to define both arithmetic and Boolean calculations.

The following built-in functions shall be available:

- a. Arithmetic (+, -, *, /) operations
- b. Boolean (AND, OR, XOR, NOT) operations
- c. Comparisons (GT, LT, EQ, etc)
- d. Trigonometric functions (sine and cosine)
- e. Exponential and natural logarithm
- f. General digital filter
- g. Minute/hourly/daily/weekly/monthly sample
- h. Minute/hourly/daily/weekly/monthly reset
- i. Average over time
- j. Current date and time
- k. Accumulated time open/closed
- l. Hourly/daily maximum, minimum and average
- m. Normalized rate accumulation
- n. Interlock (inhibit control)
- o. Setpoint Deviation

The user shall be able to create custom complex functions using expressions and a high-level language similar to or identical to that offered in the Command Sequencing option described below.

Command Sequencing

As an option, the proposed system shall provide an object-oriented visual programming development environment to allow the user to develop custom calculations and control programs. Since this environment will be used by non-programmers, the program development tools shall be intuitive and similar to other popular visual development environments such as Microsoft Visual Basic. The programming environment shall allow the user to select a statement from a menu leaving the user to just insert the arguments.

The environment shall support comments and all of the functions described below:

- Math/logic functions, with following expressions:

- arithmetic (*,/,+,-)
 - logical operators (AND,OR, NOT, XOR)
 - magnitude comparison (>, <, =)
 - absolute value
 - integer truncation
 - square root
 - circular functions (SIN, COS, TAN, ASIN, ACOS, ATAN)
 - exponential & logarithm
 - maximum and minimum in list
 - time/date
- Read and write status and analog points. Full alarm processing on calculated results.
 - Issue controls and setpoints.
 - Raise alarms.
 - Add and remove tags.
 - Issue hard copy report requests.
 - Call other command sequences as subroutines.
 - Conditional (IF-THEN-ELSE) branching and DO WHILE loops.
 - Variable delay commands
 - Two-dimensional table look-up in arrays of up to 256 x 256 elements

The system shall provide the capability to build customized template functions which become part of the library of functions available for use in command sequences and calculations.

Graphical User Interface (GUI) Environment

The operator interface shall utilize the Windows graphical user interface (GUI) environment, making extensive use of mouse point-click-drag functions, pull-down menus and interactive dialog boxes. The operator interface should support the display of multiple windows that can be re-sized, moved, overlaid in a tiled fashion, or shrunk to an icon.

Operator Displays

The system shall provide the following types of displays for use by the operators:

- Global Map Display. This type of display shall consist of a high-resolution vector map of the user's network with the current analog values and status of devices superimposed on the map. The display shall allow the operator to select displayed objects in order to issue or inhibit controls, acknowledge or block alarms, or modify operating parameters such as limits.
- Alarm Summary Display. This type of display shall show a user-customizable list of alarms that are in the system. The operator shall have the ability to acknowledge and/or block alarms and to control the operation of the audible alarm. This display shall be configurable by the operator by means of filtering by station, zone of responsibility, alarm priorities,

chronological or reverse chronological order, typeface and size of text, blocked alarms, any combination of active, cleared, acknowledged or unacknowledged alarms.

- Operator Summary Display. This type of display shall show the operations messages that have been logged by the system. This display shall be configurable by the operator by means of filtering by alarm priority, station, zone of responsibility, specific database points, time range, typeface and size of text.
- Tabular Data Display. This type of display shall list the status and analog points by station and systemwise. The information shown on this display shall include the point names, descriptions, current values and quality codes and other parameters from the database, e.g. transition counts and alarm limits. This display shall be used for operation and control in the sense that from this display, the operator can perform point operations such as control, tag, alarm acknowledge or block, as well as modify operating limits and reset transition counts.

Global Map Display

This display shall consist of a high-resolution environment in which the operator uses a movable window on a large-scale global map. The operator shall be able to navigate through the map using convenient mouse-oriented tools that include continuous panning and zooming, as well as poke points that cause the global map to jump to pre-defined displays. A user-extendable library of ready-to-use symbols, colors and text styles shall be provided.

Methods of navigation within the global map display shall include the ability to continuously pan and zoom, to jump to other displays at pre-defined locations and magnification levels and to snap to a view that is defined by rubberband mouse operation, i.e. a view selection rectangle. The global map display shall be implemented in a multilayered structure. When a map is imported from a DWG or DXF file, the layers that are contained in the DWG/DXF file should be preserved in the resulting SCADA global map. There should be no upper limit on the number layers that may be contained in the global map.

It shall be possible to assign a specific zoom level to each layer for automatic de-cluttering. Such assignments should be easy to make by navigating to desired zoom levels and clicking on pushbuttons in a dialog fashion. De-clutter levels shall not be lost when the map is re-imported from an updated DWG/DXF file. The operator shall have the ability to override the automatic de-cluttering and manually either turn a layer on or off regardless of the current zoom level. By organizing layers in a hierarchical system of folders, it shall be possible to easily turn entire folders of layers on or off. The system of folders shall be preserved when the map is re-imported from an updated DWG/DXF file.

The user shall be able to specify the number of alarm lines for the unacknowledged alarms to be displayed in an alarm banner at the bottom of any display. The alarm banner shall not resize when the operator zooms in or out on the global map display. The operator shall be able to temporarily resize the alarm banner by dragging the frame separator, showing more or less alarm lines. The operator shall be able to toggle the alarm banner on or off. It shall also be possible to acknowledge and/or block the alarms that are displayed in the alarm banner via a pop-up menu. The user shall be able to represent status points with animated GIF (Graphics Interchange Format) files. Animated GIFs are a popular way to display the change of state of a device, or motion such as a pump in operation. The operator shall be able to set the blink rate to control the speed of the GIF file.

It shall be possible to use bitmaps (image files) rather than symbols to represent status points, station points, and pushbuttons. The displayed bitmaps should scale as the user will zoom in and out. The supported bitmap file types shall include GIF, JPG and BMP. The user shall have the ability to create any number of views within the global map display. The views may be accessed via a scrollable list box or via pushbutton (poke points) on the global map display. For ease of navigation in the views list box, it shall be possible to organize the views in a hierarchical system of folders. Both the folders and the views themselves shall be preserved when the map is re-imported from an updated DWG/DXF file.

Notes

The displays shall support a system of “post-it” notes that allows operators to add and remove note icons on any display. Clicking on a note icon shall cause a pop-up window to appear to show free-form notes on any topic. The notes can be entered and modified in this window.

The system shall also support notes that are specific to database points. Such notes shall be accessible from a pushbutton in the point dialog box that appears when the point is selected. When a point has some notes, the pushbutton icon in the dialog box shall be highlighted.

Point-specific notes shall also be accessible from the alarms display. When a point-related alarm is selected, a pushbutton in the tool bar should highlight if there are notes for the selected point. Clicking on this pushbutton shall bring up the point’s notes.

Drawing File Import

The proposed system shall provide the capability to import graphics from other drawing packages (e.g. AutoCAD and GIS systems) via direct DXF and DWG file import. The layers contained in the DXF/DWG file shall be preserved as layers in the SCADA global map. The symbols, colors and text styles contained in the DXF/DWG file shall be imported into the libraries used by the SCADA global map, where they may be edited or used as is in dynamic map elements.

The system shall allow the import of multiple DXF/DWG files into the same SCADA global map. It shall be possible to subsequently re-import an updated DXF/DWG file and have its layers replace the corresponding layers in the existing SCADA global map without disturbing the graphics contained in the other layers of the SCADA map.

Control Panels

As an option, the proposed system shall include the capability of Control Panels as a tool for visualizing the data collected from IEDs in the substations.

The Control Panel shall be provided as a rapid graphical user interface (GUI) development tool that is built into the operator interface. It allows dynamic elements and database values to be superimposed over a picture. Although any picture may be used, the most common application shall be a picture of the front panel of an IED. In the case of an IED, the Control Panel operates in the same fashion and displays the same information as if the operator was standing directly in front of the device in the substation. For each IED in the substation, the user shall be able to simply select the template and to specify the station name of the IED. The system shall take care of instantiating all of the indications and controls.

It shall be possible to use picture files (*.bmp, *.jpg, *.gif) in the system GUI as well as to overlay pictures with dynamic elements of indication, analog values, and control. The user shall be able to create custom control panels and to use points from up to four different IED’s in each control panel. The successful bidder shall supply a library of control panel templates for the most common IEDs available.

Full Graphics Editor

A full graphics editor shall be provided as an integral part of the database and display building tools. Access to the editing capabilities shall be available at all local and remote consoles; however it shall be password-protected. A copy of the global map and supporting libraries shall reside on each workstation console, such that

when viewed in live mode, only dynamic data such as point values and alarms shall be retrieved from the host server in order to minimize network traffic and make feasible dial-up connections even with large displays. Publication of changes to the displays and libraries to other workstations shall be via standard file transfer mechanisms.

The full graphics editor shall allow the user to create any number of layers and displays of the global map. The editor shall allow the user to assign zoom levels to each layer for automatic decluttering. The editor shall allow the user to specify an image file for any display that is to be used as a background for the display. The image file formats that can be used for this shall include JPG, GIF and BMP.

The full graphics editor shall contain easy-to-use tools for re-layering, re-coloring and re-styling (text) as well as duplication (copy/cut and paste), stretch and re-size. The full graphics editor utility shall provide topological support. It shall allow consistency checks between the graphical display and the corresponding database. Connectivity information shall be stored in the database in order to allow the topology to be dynamically changed.

Drawing Tools

The proposed system shall include drawing tools as part of a full graphics editor to allow the user to add to and/or modify the drawings that were imported via DWG/DXF file. The drawing tools that are provided in edit mode shall include at least the following capabilities:

- a. draw line
- b. draw rectangle (open and filled)
- c. draw polygon (open and filled)
- d. draw circle and ellipse (open and filled)
- e. draw arc (open and filled)
- f. insert text
- g. insert symbol
- h. insert dynamic element (e.g. point or poke point)

The following editing functions shall be provided:

- o cut and paste
- o rotate
- o snap to grid
- o stretch

The following alignment tools shall be provided:

- o Align objects left
- o Align objects right
- o Align objects top
- o Align objects bottom
- o Center objects vertically
- o Center objects horizontally
- o Distribute objects vertically
- o Distribute objects horizontally
- o Distribute objects matrix (user details the number of rows and columns)
- o Resize to maximum selected object height
- o Resize to maximum selected object width
- o Resize to maximum selected object height and width
- o Resize to minimum selected object height
- o Resize to minimum selected object width

- Resize to minimum selected object height and width

The editor shall support at least 99 undo and redo editing changes.

The user shall be able to create libraries of the following:

- drawing styles (colors and line styles)
- text styles
- symbols
- dynamic elements

The system should include an initial ready-to-use set of such libraries. On import of a DWG/DXF file, the colors, text styles and symbols that are contained in the DWG/DXF file should be imported into the libraries, where they may be customized or just used as is.

The display editors shall allow the user to define displays of dynamic data fields as follows:

- i. analog values
- ii. status values
- iii. station alarm status
- iv. remote station status
- v. dynamic line segment coloring
- vi. historical data trend graphs
- vii. text strings

The proposed system shall provide the capability to display a telemetered or calculated analog value in the form of a numeric string, horizontal or vertical bar graph (the length of a bar graph reflects the value of the analog point), or in an analog gauge. Both numeric strings and bar graphs shall be color-coded to reflect any violation of alarm limits. The color-coding shall be user-definable. It shall be possible to create multiple color-coding schemes. Analog gauges shall have the capability to represent a meter or dial type gauge. The user-definable properties shall include: angle start, angle length, dial color, dial direction, label properties, limits properties, major/minor divisions, needle properties, and the radius. The proposed system shall provide the capability to display the state of a telemetered or calculated status point by means of a user-definable dynamic element that specifies one of the following:

- a set of four symbols
- a set of four text strings
- one symbol and a set of four colors.

Two-state points shall use only two of the four symbols, strings or colors.

Data Quality

The proposed system shall provide the capability to display data quality indications adjacent to each analog value or status point indication. These shall include the following as a minimum:

- a. telemetry failed
- b. manually set
- c. calculated from manually set data
- d. alarm blocked
- e. out-of-range
- f. tagged
- g. interlocked

Database Editor

The system database shall be defined and maintained with the help of an interactive database editor. The database editor shall be of Windows dialog style and shall be supported by a detailed database manual that explains the format, purpose and interrelationships of all database fields.

The database editor shall provide a graphical tree-like representation of the complete database and shall support easy navigation throughout the database to the desired items to be edited. Database items to be edited in this way shall include Stations, Communication Lines, Communication Channels, RTUs, IEDs, as well as all the individual database points (analog values, status indications, accumulators, etc). The database editor shall operate as a "client" program which communicates with a "server" program running on the host computer. However the database editor shall be able to run on any computer that is connected to the host server via the network. With this arrangement, it shall be possible to manage the database maintenance from any suitably configured PC on the network without being necessary to go to the control room to do it.

The database editor shall include features which will make it easy to create and modify the database such as:

1. using the Station Cloning feature to create an entire new station and all its points, based on an existing station;
2. copying, cutting and pasting in the Windows environment;
3. using a model feature to create points and other database items that are based on previously created ones;
4. using a Station Rename feature to copy a portion of an existing display, and to reassign all those dynamic points to points in a different station, all in one operation;
5. editing or modifying the database on an MS Excel spreadsheet and importing it into the system real-time database;
6. deleting existing database points;
7. providing a consistent "look and feel" to the system.

All changes and updates of the database shall be completed and validated while the system is in online operation. Under no circumstances shall the real-time system operation be interrupted or disturbed by the database editing and maintenance process.

IED Wizard

The proposed system shall provide an IED Wizard feature which automates the creation of the database for an IED. In just a few simple steps, it shall be possible to create not only the required points in the real-time database system, but also, for an IED that is a slave to an RTU, the mapping of these points for automatic download to the RTU.

The IED wizard shall contain an extensive library of the most common IEDs that are available on the market. The mapping process shall be based on a series of intuitive templates that will guide the user through the process. The user shall be able to select from a list of devices for each IED vendor, specify a unit address and the point group, and drag the point group into the RTU's point map. All of the telemetry and control addresses and RTU-to-IED mapping shall be automatically generated. The IED Wizard should completely eliminate the tedious error-prone data entry of telemetry addresses and mapping tables.

The user shall be able to create for each IED multiple templates with different sets of point definitions. The vendor shall supply tools for creating templates for those IEDs or devices that are not in his current library. Templates shall be easy to modify and an unlimited number of different versions or variations of the same or similar templates shall be possible to handle for use in the system.

User Rights and Privileges

The proposed system shall provide for a highly secure environment which only allows authorized users to interact with the system and its database. There shall be user names and passwords assigned on all servers and workstations for general operating login. There shall also be user names and passwords assigned on all workstations for login to the SCADA functions. The user name, password and user rights shall be defined in a user account. Each user account shall be assigned a set of user rights that determines the actions that the user may take. This shall provide individual control over various operating and editing functions. As a minimum, the user rights for normal operation shall determine the access of a user to the following functions:

1. alarm acknowledge
2. alarm page acknowledge
3. alarm block
4. alarm unblock
5. alarm station acknowledge
6. alarm silence
7. manual set operations
8. control points operations
9. activate points operations
10. tag points operations
11. run command sequences

In addition, the user rights for changes to the system shall determine the privileges of a user for the following functions:

- a. edit database
- b. edit display
- c. edit report
- d. edit analog limits
- e. edit notes
- f. edit control sequences

Each user account may also be assigned Privilege Mode or Training Mode. If neither of these is assigned, the user is in Normal Mode. Privilege Mode shall be required to access certain high-level functions in the system depending on the applications. Training Mode shall restrict the operator to only those stations in the database that are also in training mode. This shall prevent the operator from controlling real system devices in training mode. Each user's account, functional levels, zones of responsibilities, etc, shall be controlled from an access management set of displays. Only the system administrator shall have the right to edit and modify the access management displays.

The proposed system shall be able to handle an unlimited number of user accounts with their corresponding user rights and privileges.

Alarm Processing

The system shall alert the operator when abnormal conditions or certain events that are designated as being important occur such as:

- a. any uncommanded change in a status input or calculated status;
- b. any analog input or calculated value that crosses over any defined alarm limits;
- c. any commanded change of a control & indication point that does not result in a back-indication within some specified period;
- d. any failure of the Master Station to communicate with any RTU;

- e. any failure of a given RTU to respond correctly to a previously specified number of interrogations;
- f. any failure of a major component of the SCADA system.

Alarms and operational events shall be continuously synchronized in real-time to the standby host server, in the case of a dual-redundant system configuration.

The proposed system shall be able to handle a minimum of 100 alarms or events per second per operator consoles regardless of the other workload.

Alarm Priorities

The system shall provide at least five (5) alarm priority levels. Alarms with priority zero - the lowest, shall be considered to be pre-acknowledged. Such alarms shall neither sound any audio alarm signals nor cause points to flash on the display. Higher priority alarms shall require acknowledgement and shall sound audio alarm signals. The audio alarm signals shall consist of .WAV files that can be assigned to each priority. All alarms shall be logged regardless of priority to at least three destinations: alarm summary displays, event printers and operator log files.

For each status point, it shall be possible to define which state (0 or 1) is abnormal and to assign a separate alarm priority to each state. When either the select or execute check-back fails, the system shall generate a check-back failure alarm. If the check-back is successful but the expected status change does not occur within a timeout period that is user-definable for each control, the system shall generate a control failure alarm.

For each analog point, the user shall be able to define three sets of nested upper and lower alarm limits, with a separate deadband for each limit. In addition, analog points shall be able to generate an alarm when a rate of change is exceeded, either in the increasing or decreasing direction, or both. Each alarm limit shall support a separate alarm priority. The system shall provide the operator with a visible "telemetry failure" indication when the value of any displayed point is not currently being updated by the system because of an RTU or communication line failure. Any points that are calculated using, as inputs, the values of other telemetry failed points, shall also be marked telemetry failed.

The user shall be able to specify any Windows sound file (*.WAV) to be used for the audio alarm signal. The system shall allow the user to browse for sounds and to test play the selected sounds. The system shall allow different sounds for each alarm type and a different set of sounds for each workstation.

Alarm Formatting

The user shall have control over the format of alarm messages by means of alarm format statements. As a minimum, the message format editor shall allow the user to incorporate the following into the alarm messages in any desired sequence:

- a. strings of fixed text
- b. name of the point in alarm
- c. point description
- d. station name of the point in alarm
- e. station description
- f. alarm priority level
- g. point value or status
- h. alarm limit that was violated (for analog limit violation)
- i. calculated rate-of-change that violated the rate-of-change limit
- j. point engineering units

The system shall provide summary lists for all unacknowledged, acknowledged, blocked, suppressed and for all alarms. The user shall be able to perform alarm filtering based on certain parameters or filters. The filtering of alarm summary lists shall be performed from a template where the operator can enter the filtering parameters and obtain the filtered lists.

Master/Slave Alarm Suppression

The proposed system shall provide a Master/Slave Alarm capability that allows the user to define a hierarchy of primary/secondary (master/slave) alarm point relationships. This feature shall allow the user to focus on the conditions that are the real cause of a disturbance by filtering an avalanche of alarms and presenting to the operator only those that are really important. The master/slave relationship may be used for either or both of the following purposes:

- Alarm Suppression
If the alarm suppression function is enabled for a particular master/slave relationship, then as long as the master point is in the alarm state, alarms on its slave points will be suppressed (i.e. the alarm severity is reduced to zero). The suppression may be specified to be either time-limited or indefinite.
- Group Acknowledgement
If the group acknowledgement function is enabled for a particular master/slave relationship, then whenever the user acknowledges alarms on the master point, he/she also acknowledges alarms on its slaves.

Each master point shall be able to have any number of slaves, each slave shall be able to can have any number of masters, and a slave shall also be able to be a master and have slaves of its own.

The Master/Slave Alarms option described above shall also allow the user to suppress alarms of any desired priority (typically the low priorities). This feature shall allow the user to exclusively focus on the most critical alarms in the system and once these have been handled, the operator can look at the lower priority alarms. Alarms that are suppressed in this manner shall be hidden from the alarm lists until the user un-suppresses the corresponding alarm priorities. The alarms must be recorded in the database, however, and become viewable as soon as the suppression is removed. Such alarms should be automatically acknowledged when they become viewable.

The above features shall be fully integrated into the SCADA system with no need for any third party software.

Remote Alarm Annunciation

The proposed system shall have the ability to remotely transmit any pre-defined alarm condition to any commercial paging system, e-mail or SMS (short-message-service). There shall be no limit in the number of alarm conditions that are required to be remotely annunciated. This function shall be fully integrated into the SCADA system and no third party software shall be required to achieve the functionality. The communication between the remote alarm annunciation system and the annunciation providers shall be available over serial connections, e.g. modems, as well as over TCP/IP wide area networks, e.g. Ethernet, VPN, Sonet/SDH, satellite, etc.

The system shall have the capability to send e-mails for alarm messages. The user shall be able to define which points are annunciated in this fashion, and for each point, which alarms, e.g., which states for a status point and which limits for analog point. The system shall also have the capability to call a central paging computer service to forward alarm messages to digital pagers. The user shall be able to define which points are annunciated in this fashion, and for each point, which alarms, e.g. which states for a status point and which limits for analog point. The pagers shall be identified in up to eight groups, with up to 30 pagers per group. For each group, the user shall be able to specify the telephone number of the paging computer, and the alarm priorities and zones of

responsibilities of the alarms that are to be sent to those pagers. The same alarm may be directed to multiple pager groups.

The user shall be able to define a schedule for remote alarm annunciation so that it starts automatically after hours and turns off automatically in the morning. The user shall also be able to specify an annunciation time delay, so that if someone is in the building but not in the control room, he/she will have time to come back to the control room and respond to the alarm before someone is paged. The user shall be able to specify a re-annunciation time interval, such that if the alarm is not acknowledged after this time interval, the page will be re-issued.

External Alarm Bell

For operations under noisy conditions or remotely from the control room, the external alarm bell feature shall be used to control (activate/de-activate) several different external alarm bells based on alarm priorities for any of the alarm zone groups. A local RTU may be required for enabling the control of the external alarm bells. Audible alarms shall still be generated at each workstation by the operator interface.

Event Data Recording

The SCADA system shall maintain an event file that records all status changes, operator controls and SOE data. This file shall be re-sizable to store several million events, if desired. Non-SOE events shall be time-stamped to the nearest second. SOE data shall be stamped to the nearest 1 millisecond, subject to the capabilities of the RTU protocol. The operator shall have the ability to request event data reports with time range and point search capabilities.

Report Generation

The system shall support a report generation capability that will allow the user a high level of flexibility in the definition, formatting and scheduling of on-demand and periodic reports. The reports shall include data from both the real-time database the historical database. The system will allow the user to schedule reports for automatic printing or saving to hard disk files for subsequent transfer to CD or tape. The system shall use commercial tools such as Microsoft Excel and Access to generate the reports.

Report Editor

A report editor shall be available to allow the user to define reports by specifying a database table, a set of desired data fields and the selection criteria for retrieving records from the database table. In a report definition, the user shall be able to specify:

- a. Choice of database table to access (e.g. status points, alarm file)
- b. Choice of the data fields available in the chosen table
- c. Filtering by the value of any data field in the selected table
- d. Ordering data by value of any data field
- e. Grouping of displayed data according to any data field

Examples of such selection and filtering requests are reports for:

1. points in specific "point type" categories
2. points in certain stations

3. points in certain zone(s) of responsibility
4. points associated with a specific communication line
5. points that are manually set
6. analog values that are in out-of-range condition
7. points that are tagged
8. points in alarm condition

A graphical report in the form of scheduled prints of selected views of the global map shall also be provided. The system shall include a scheduling facility that will allow the operator to define the schedules and destinations for all reports. It shall be possible to direct a scheduled report to multiple printers, one or more of which can be directories on disk.

Data Export to MS Excel and MS Access

The proposed system shall be provided with direct interfaces using open standards such as ODBC, DDE and SQL that will allow the user to export real-time and historical data from the SCADA system to MS Excel and MS Access. All data points in the database, not just values, shall be available for export.

The user shall be able to specify the desired data fields, the column headings, as well as to define compound selection criteria that will filter the data to be exported, e.g. Value > 100, or Value < 100. The process shall not require any programming by the user, but rather a direct pointing by mouse clicks to the data desired to be included in the spreadsheet. The user shall be able to save multiple queries on the same spreadsheet or on multiple spreadsheets and to have queries automatically executed when the spreadsheet is invoked.

The system shall provide the ability to set timers to have one or more queries periodically executed at fixed time intervals as well as on a pre-defined change.

Data Collection and Storage

The system will provide a historical data collection facility that allows the user to define the points that are to be sampled, the sample frequency and how long to retain the sample data. In each dataset, the oldest samples should be overwritten by the newest.

The collected historical data must be able to be trended, included in reports, exported to MS Excel or MS Access or transcribed to relational databases.

The historical data software shall be capable of sampling at intervals as low as 1 second. There should be no upper bound on the duration of samples within each dataset, and thus no upper bound on the amount of historical data that can be stored other than the limitation imposed by available disk space.

The historical data software shall allow the user to specify recording of statistics in the sample records. The statistics shall include time averages, summations, maximums and minimums, and times of maximums and minimums and shall be based on user-definable observation intervals.

The system shall also allow the user to create "secondary" datasets that extract information from primary datasets. For example, a primary dataset could contain 15-second samples for several days. A secondary dataset could extract daily maximums and minimums, as well as the times of the maximums and minimums and record these for ten years.

Historical Information System

As an option, the proposed system shall provide a Historical Information System (HIS) function which allows the user to transcribe real-time database values, historical data, operation messages and alarm and event logs including SOEs onto a relational database management system. The HIS function shall use as a platform any of the established commercial relational database management systems including MS Access, MS SQL Server, Oracle, etc.

The ability of transcribing the current real-time database values shall be bi-directional, i.e. it shall be possible to transcribe data from a table into a relational database into real-time database points. If a real-time database point is manually set, the transcription program shall not update it.

The system shall provide the ability to transcribe data to multiple databases on multiple platforms. For each target database, the user shall be able to specify exactly what is to be transcribed, e.g. what points and what historical data tables. Also the user shall be able to specify the schedule of transcriptions.

The transcription process shall maintain a connection to the currently active host computer during a failover from one host to the other. The transcription process shall be able to keep track of where it left off since the last connection, and in case of a period of downtime, it shall be able to recover all historical data that was not transcribed during the downtime.

Data Trending

The proposed system shall provide the ability to store and view any data value from the database in a trend graphical format. The system shall bring up pixel-resolution trend graphs of historical data. Sample rates as low as 1 second must be supported.

Trend graphs shall be displayed in separate windows that can be moved, re-sized and minimized to an icon. The trend graph window shall include tools that allow the user to configure and customize the graph display. A trend graph window shall have the ability to plot at least five points from the historical database. The trend graph displays shall be interactive allowing the operator to quickly adjust the time frame, duration and resolution of the graph.

In cases where there are more samples in the dataset than can be displayed in the graph window, it shall be possible to scroll back in time. It shall be possible to see the numeric values and time-stamp of the traces at any time position in the graph by manipulating a time cursor inside the trend graph.

The user shall be able to display trend comparison graphs from left to right, for at least five comparison trends. In trend comparison graphs, the time origin at the extreme left of the graph is a fixed time of the day; however it may be a different day for each trend. The purpose of this is to allow the user to observe the build-up of the current day's trace, e.g. a load curve, against that of other days in the past, typically the days that contained the last week peak or the current month peak, etc. The trend comparison graph shall have an option to set a start time and day of the week so that the trend graph is automatically launched.

Disturbance Data Capture

The proposed system shall provide a disturbance data capture function that allows the user to analyze the entire state of the system leading up to, during and after a disturbance. All changes in analog and status points system-wide are recorded when a user defined disturbance is detected.

The user shall be able to define the pre- and post-disturbance duration and sampling rates. The pre-disturbance duration shall be definable from 1 to 15 minutes with a sampling rate of 15 seconds to 15 minutes. The post-disturbance duration shall be definable from 1 to 15 minutes, with a sampling rate of 5 seconds to 15 minutes.

A disturbance data capture editor shall be provided that allows the user to specify which points can trigger disturbance captures, and for each point, what would signal a disturbance. Status can trigger a disturbance capture for any change of state which is either Abnormal, or Open, or Closed, or any other change. Analog points can trigger a disturbance capture for any limit violation. There should be no limit other than that imposed by disk space on the number of disturbance capture files that can be accumulated.

The system shall keep a log of all disturbances, detailing the date and time of the disturbance, the point that triggered the disturbance, the reason code, and the recorded length pre- and post-disturbance. The disturbance data capture shall include a viewer facility which allows the user to analyze points from anywhere in the system for a given disturbance. The viewer facility shall also allow the user to select any disturbance file and export it to commercial applications via ODBC or SQL for further analysis.

Operations and Outage Accounting

The system shall provide a function that maintains operations and outage accounting data for user-specified breakers. Operation counts for both commanded and uncommanded operations shall be maintained for each breaker. An alarm shall be generated when the total operation count for a breaker exceeds the user-definable limit for that breaker.

A Device Operations Report shall be available for each breaker showing the date and time of last operation, number of operations caused by control, or caused by protective relaying, operation count limit, number of operations divided by operations limit as a percentage, and limit status: OK, Warning, and Exceed.

The report shall highlight devices whose operation counts are within a user-definable percentage of their warning limits, or that have not been operated for a user-specified number of days.

An Outage Report shall be available showing, for each outage in the last N days, where "N" is user-specified, the name and description of the device, date and time of the start of the outage, and the duration of the outage, three phase currents that were present immediately before the outage, and a summary of the accumulated total outage time for each device during the requested reporting interval. Outages that are less than one minute in duration, and those caused by an operator initiated control shall be excluded from the outage report.

Operator Training Simulator

As an option, the proposed system shall provide an Operator Training Simulator (OTS) function that creates a parallel real-time environment for training and simulation studies.

The operator training simulator shall include an instructor's control panel that allows an instructor to start and stop the simulator, take current real-time database snapshots, save and load previously saved study databases, and execute scripts. It shall not be necessary for the user to build a separate database and displays.

The operator training simulator shall provide the means to create simulation control files containing If-Then-Else rules that determine how the simulator will react to the trainee's actions, or to events triggered by the instructor's scripts. The instructor shall have the ability to maintain a library of simulation control files that have been pre-defined for different operator responsibilities, or for varying levels of difficulty for the trainee.

To support What-If studies, it shall be possible to have operator interface windows open to both OTS and the real-time system on the same workstation at the same time. The user should not have to log in and out to switch between OTS windows and real-time windows. The operator interface windows that are connected to OTS shall have some clearly visible distinguishing characteristic so that they are not mistaken for real-time windows.

ICCP (Inter Control Center Protocol) – TASE.2

As an option, the vendor shall propose a data link based on the ICCP protocol. ICCP (Inter Control Center Protocol) is an IEC industry standard (TASE.2) for Master Station to Master Station communications. The ICCP application shall consist of both client and server software. The client software shall connect to other members on the network to request point data and forward control requests from operators and application programs. The server software shall respond to client requests by returning the requested data and executing, if possible, the requested controls.

The proposed system shall not have any limitation in the number of communication nodes (remote clients/servers). No software upgrades or additional licenses shall be required to increase the number of communication nodes to be accessed via ICCP. The system shall provide the ICCP function on the host servers. It shall not be acceptable either to use separate servers to handle the ICCP function, or to use third party software to achieve ICCP connectivity with other systems. This should ensure that it will not be necessary to redefine the ICCP database points in other databases and/or servers other than the real-time database servers. The proposed ICCP function shall include a database editor which allows the user to specify what data points are to be transmitted to the partners. The selected data points may include status changes, analogs and calculated values from the real-time database. Quality codes, such as manual set and telemetry failed, shall be transmitted along with the data. In device control operations, tags on the server system shall be respected.

Any member of the ICCP network can act as either a client or a server or both. The relationship between any pair of members may be fully bidirectional. That is, both members may act as both client and server to each other. Furthermore, any member may act as a server to multiple clients, and at the same time act as a client with multiple servers. Establishment of the connections shall be the responsibility of the client software.

The proposed ICCP software shall support at least the conformance blocks 1, 2 and 5.

Network Topology Processor

A network topology processor shall be provided that calculates the energized/de-energized and pressurized/depressurized status of electric, gas and water line sections, and displays them on global maps. The connectivity calculation shall be based on the topology of the distribution system and the current status of breakers or valves. For areas that are energized or pressurized, the connectivity calculation shall also indicate where the network is paralleled and/or looped. When a circuit becomes de-energized, depressurized, or paralleled and/or looped, an alarm shall be generated to alert the operator.

The color-coding used to indicate line section status shall be user-definable. Multiple color-coding schemes shall be supported. The user shall be able to assign different energized colors to different feeders and have the display propagate that feeder color to all line sections that are connected to that feeder. The user shall be able to specify separate colors for looped and paralleled conditions.

For an electrical line section, the system shall compute the status of each phase independently, such that line sections that are downstream of non-ganged switching devices may contain both energized and de-energized phases. The user shall be able to specify colors for “partially energized” or “partially looped” etc.

The topology processor shall also be able to highlight portions of the network that have anomalies in the form of limit violations and/or excessive rate of change for associated analog quantities. The analog points used for this purpose shall be identified in the line section database. The user shall be able to specify colors to be used to highlight all line sections downstream of such anomalies. The topology processor shall also include a feeder trace function that allows the user to select a trace color and have the length of a feeder highlighted in the selected trace color. Multiple simultaneous traces in different colors shall be supported.

The topology database shall be entered by means of an interactive graphical line section editor built into the display editor. For an electrical network, the user shall be able to specify any combination of phases in each line

section. It shall not be necessary to use separate line sections to represent each phase of a circuit element that is controlled by non-ganged switching devices upstream.

The user shall be able to call up the line section data by clicking on the desired line section on the display. The line section data window that appears shall show the status of each phase contained in the line section, the number of customers, and also identify the source feeder for each phase. If the selected line section is downstream of a substation, the line section data window shall identify both the upstream substation feeders and the transformer station feeders that feed the circuit. If the selected line section is above the substation level, the line section data window shall only identify the upstream transformer station feeders.

Switch Order Preparation and Management

The system shall provide a switch order preparation and management function. A switch order is a series of steps involving both switching operations and tags that shall result into conditions for which a clearance may be issued. Two types of switch orders are required:

- Order to operate
This shall be used to define switching actions and application of tags. An order to operate is executed prior to issuing the accompanying clearances.
- Restoration order
This shall be used to define switching actions and removal of tags in order to undo the work performed by an order to operate. The restoration order is executed after all of the clearances associated with the order to operate have been surrendered.

Switch order editing should be interactive and be performed using the GUI (graphical user interface) by clicking on the device to be operated and selecting from a menu the type of operation, e.g. open, close, tag, etc, and the label to be used. If special conditions require an operation that is not in the operations menu, the user shall be able to type in the desired operation. Similarly, if the equipment involved is not represented by a database point in the SCADA system, the user shall be able to simply type in its name and location. Each switch order shall be able to contain up to 200 sequences. It shall be possible to edit sequences in an existing switch order and to easily change the order of the sequences. The sequences shall be annotated by means of a short text string of up to 20 characters. The annotation shall be done either during editing or execution of the switch order. It shall be possible to frequently save used switch orders as templates for later re-usage.

Before a switch order can be executed, it shall be mandatory that it be checked (authorized) by having an authorized person log in and click on a pushbutton. This would usually be done by a supervisor, but it shall be possible for an operator to do it in an emergency. The check function shall be logged and the login account name of the person who did it shall be included in the log message as well as displayed on the switch order form. When a switch order is printed that has not yet been checked, the printout shall include the word "unchecked" in the background. If a checked switch order is modified, it shall be necessary to have it checked again before it can be executed. The user shall be able to create up to five associated clearances for each switch order. A completed clearance record shall contain the following information:

- Title, type of clearance and job number
- Date and time the clearance was issued, and to whom
- Date and time the clearance was surrendered, and by whom
- Associated clearance number, entered if the clearance is issued on behalf of another company
- Date and time grounds were applied, recorded after the clearance has been issued
- Date and time grounds were removed, recorded before the clearance can be surrendered
- Reason for the clearance
- Remarks
- Up to 50 tags

Once a clearance has been issued, the operator shall not be able to change anything in the clearance until the clearance has been surrendered, except to update the remarks field and to record when grounds have been applied and removed. If a switch order has an associated clearance, the restoration order shall not be allowed to be executed until the clearance has been surrendered. The clearance shall not be allowed to be surrendered until removal of the grounds has been recorded.

The user shall be able to create switch order sequences not only on the active real-time system, but also in simulation mode, so that the user is able to verify the effect of the switching sequence on the network topology prior to executing it in real-time mode. Switch orders thus created in simulation mode shall be able to be saved as templates.

Interface to GIS Systems

As an option, the proposed system shall include a GIS interface as a dynamic data link to the user's current or future GIS system. The preferred interface to the GIS system is a MultiSpeak Version 2 compliant interface. A MultiSpeak compliant interface allows a seamless integration between SCADA, GIS and other enterprise applications such as engineering analysis software, customer information systems, etc.

The MultiSpeak based interface between the SCADA and GIS system shall allow the automatic data transfer in real-time in both directions. It shall also allow the import in batch mode of the entire spatial database from the GIS, or AM/FM system, into the real-time SCADA database without any need for manual intervention for updating of data. The GIS spatial database will contain the topology and connectivity information as well as all the equipment characteristics.

CHAPTER 6 – SYSTEM IMPLEMENTATION

Project Schedule and Coordination

The prospective bidders shall submit a narrative project approach, project team and qualifications, workplan and schedule with the bid proposal as identified in the Request for Proposal.

System Testing

The Vendor shall provide two levels of equipment and software tests:

1. Factory Acceptance Test (FAT).
2. Site Acceptance Test (SAT) or field test.

The successful bidder shall prepare test documentation and test logs necessary for all factory and site tests to the satisfaction of the City. The purpose of these tests is to demonstrate that the functional, performance, availability and other requirements in this specification are met. The test procedure document shall be prepared by the Vendor and shall follow a consistent format and be submitted to the City for review. The formal factory acceptance test shall not take place until the test procedure document has been reviewed and agreed upon by the City. The City reserves the right to modify, add to or remove items from the test procedure document as they see fit.

Discrepancies found during the testing shall be documented and maintained in a problem log file. The subsequent correction shall be described and representatives of the City and the successful bidder shall verify proper operation. Faulty and/or incorrect operation of major functions (major discrepancies) may, at the discretion of the City, be cause for the suspension or restarting of the entire test, pending the correction of the problem. Minor discrepancies shall be corrected and re-tested. The City may request that other modules that may be impacted by the correction be re-tested also.

The System shall not be shipped until the City certifies successful completion of the factory test. Shipping delays due to testing failures shall not be considered an unavoidable delay. The possibility exists that for some presently unforeseeable reason, the City may approve the successful bidder's request for shipment of the system before it successfully passed all the factory tests. If such approval is given, the shipment of the system shall not constitute nor imply a waiver of any requirements. Re-testing of requirements not met during factory testing will be part of the site acceptance test (SAT).

To provide the City full confidence in the System, unstructured time shall be provided during the factory test. The City shall be allowed at least 32 normal work hours (from 7:00AM to 4:00PM on regular workdays) for this unstructured testing. Unstructured testing will consist of the City determining what tests to perform for any or all of the subsystems or the system as a whole. The City will have available to them the necessary Vendor personnel and test equipment needed to carry out any test deemed necessary by the City. At a minimum, the Seller shall have personnel to monitor all phases of the unstructured test.

Shipping and Installation

All equipment deliveries shall be F.O.B. destination prepaid and allowed to the City's EUD Dispatch Center located in 1331 South Ham Lane, Lodi, CA. Deliveries shall be sent to the Manager of Engineering & Operations Division.

The successful bidder shall provide all plans and procedures necessary for the system installation and integration. This includes all supplied equipment, including third party or subcontractor equipment the Vendor is providing or has made part of its system. This also includes hardware recommended by the Vendor for purchase by the City to support the system. The City shall have the opportunity to review all installation plans and procedures prior to installation. The City will prepare all sites for the installation of equipment in coordination with the successful bidder.

The successful bidder shall be responsible for starting up the system. The purpose of system startup shall be for the Vendor to verify that all system functions that were demonstrated during FAT now operate properly under actual field conditions. This shall include all application programs. The main purpose of system startup shall be to prepare the system for SAT. The SAT shall include helping establish communications at the master station to all substation facilities and to the existing sites for wells, pumps and/or lift stations as determined by the City.

The City will provide general service power, lighting, and room/equipment air conditioning. The successful bidder shall indicate the general service circuit capacity, environmental, and protection requirements for each headquarters and field equipment installation as applicable.

Site Acceptance Test (SAT)

In coordination and under the guidance of the successful bidder, Site Acceptance Testing (SAT) shall be conducted at the City's facilities. Following the successful start-up of the headquarters and remote equipment, the City personnel shall re-conduct the factory acceptance test and other tests in a field environment. The SAT period shall be re-initialized whenever a major problem, in the opinion of the City, is encountered. All requirements in this specification must be met for successful completion of the site-testing milestone.

Any problems encountered during SAT will be reported immediately. The successful bidder shall promptly correct all problems encountered with its own field service personnel unless the City agrees to provide personnel for a particular item. Successful completion of SAT means the City is satisfied that the system has met all requirements described in this specification, excluding warranty provisions and other items that survive the site-testing milestone.

The SAT may include re-executing structured test procedures used in the FAT as reasonably necessary as well as executing test procedures that could not satisfactorily be demonstrated in a factory setting. The SAT may also include unstructured tests. Furthermore, the site testing shall include verifying system capabilities to communicate as expected with RTUs and to interface as may be expected with other information systems. Personnel from the successful bidder shall be present and shall be coordinating all the activities during the test process.

Support Plan

The City shall have the option to purchase maintenance and support plan on at least an annual basis. The City will determine if it wishes to load the fix or update or wait for a single annual enhancement. The software updates are to keep the City's system current with the latest product releases offered by the successful bidder.

The successful bidder shall propose options for two level of response: business day only and 24x7 support plans. Response times within 30 minutes from the call shall be required for critical problems. A response means a qualified person from the successful bidder's organization has contacted the City and is working on the problem. The successful bidder shall provide remote diagnostics support from Vendor's facilities via a dial-in or VPN connection at City facilities. The City shall have the option to accept or decline the support plan prior to the warranty period ending. The Vendor shall properly inform the City of Lodi 30 to 60 days before expiration of the warranty period that there is a need to address continuation of a support plan.

The Vendor shall recommend and include in its proposal, reasonable quantities of spare parts. For hardware that is not widely available from common third-party hardware providers, e.g., CISCO, Dell, HP Compaq, etc, the Vendor shall provide a complete spare parts list.

Training

The successful bidder shall make available to the City, training on the operation, maintenance, failover/startup, recovery, application software, display, and database maintenance. The class training shall be conducted at the City of Lodi including the Dispatcher/Operator training classes.

Training course outlines shall be included in the bidder's bid. Each course outline shall include, in addition to the subject matter, a short review of the prerequisite subjects, how this course fits into the overall training program, and its objective. Qualified and experienced personnel from the successful bidder shall conduct the training.

The City's staff shall receive individual copies of the training materials and pertinent documents prior to the scheduled start of the course. A suggested training plan and schedule suitable to the needs of the City shall be provided as part of the proposal. The plan and schedule shall include a description of the training classes and prerequisites, proposed order of the classes, length of classes, the minimum and maximum number of attendees per class, and standard cost per attendee.

Documentation

The documentation requirements shall apply to all items described in this specification. This includes all items provided by subcontractors or suppliers of the successful bidder unless specifically noted otherwise. The successful bidder shall provide a complete documentation list/inventory and shall update it periodically during the project to reflect what documentation has been delivered.

The software documentation shall provide, through a set of logically coordinated documents, a comprehensive and detailed description of all software necessary for the operation and maintenance of the proposed system. It shall describe the system's overall functions, subsystems, databases, macros, libraries and procedures. The requirements in this section do not apply to Original Equipment Manufacturer (OEM) provided software, e.g., operating systems). For OEM provided software, the standard OEM manuals shall be provided.

The successful bidder shall provide the documentation electronically wherever it is appropriate. At a minimum, two (2) complete printed sets of all documentation - standard and project specific - shall be provided to the City.

APPENDIX “A” – SYSTEM SIZING REQUIREMENTS

1. Communicate with existing 49 RTU's via Bell 202T modems
2. Number of status= 24-72 indications, 16-208 analogs, and 0-56 control points at each RTU –see appendix B
3. Provide 2 Host / Servers
4. Provide redundant SCADA (2) LAN's (servers should be able to connect / swap to both LAN's independently)
5. Number of operators consoles 3 consoles with (3 monitors on the main control console) and 2 for the relief shift desk
6. Utilize existing loggers Dot matrix printer for alarm logging via serial link from Dec Server provided by the successful bidder
7. Utilize existing network laser or ink jet printers for reports, alarms summary, historical graphs etc.
8. Utilize 47 communication lines via Bell 202T modems to communicate with remote RTU's
(Note: 2 field RTUS share same leased line)
9. Utilize existing leased lines and Bell 202T modems for connection to field RTU's
(City staff to identify and assist in wiring)
10. Protocols used by the RTU's = Telgyr 6000-6500 or equivalent, Telgyr 8979
11. Provide additional protocols desired for future use = Modbus RTU, DNP 3.0
12. Number of analog points to be stored in the historical database = 500 at 15 minute interval,
13. Number of months for storage of historical data = 15

APPENDIX “B” – RTU Information

#	RTU NAME	LOCATION	# ANALOG	# INDCIATION	ACCUM.	SOE	# SBO	ANALOG SET.	PROTOCOL	COMM. LINE	ADDRESS
1	HS	HENNING SUB.	72	80	16	0	56	8	TG6000	HENNING	1
2	MS	MC LANE SUB.	64	80	16	0	40	0	TG6000	MCLANE	1
3	KS	KILLELEA SUB.	80	80	16	0	56	0	TG6000	KILLELEA	1
4	W1	WELL 1	24	32	16	0	8	0	TG6000	WELL 1	1
5	W2	WELL 2	24	32	16	0	8	0	TG6000	WELL 2	2
6	W3	WELL 3	24	32	16	0	8	0	TG6000	WELL 3	3
7	W4	WELL 4	24	64	16	0	16	0	TG6000	WELL 4	4
8	W5	WELL 5	24	32	16	0	8	0	TG6000	WELL 5	5
9	W6	WELL 6	24	32	16	0	8	0	TG6000	WELL 6	6
10	W7	WELL 7	24	32	16	0	8	0	TG6000	WELL 7	7
11	W8	WELL 8	24	32	16	0	8	0	TG6000	WELL 8	8
12	W9	WELL 9	24	48	16	0	8	0	TG6000	WELL 9	9
13	W10	WELL 10	24	32	16	0	8	0	TG6000	WELL 10	10
14	W11	WELL 11	24	32	16	0	8	0	TG6000	WELL 11	11
15	W12	WELL 12	24	32	16	0	8	0	TG6000	WELL 12	12
16	W13	WELL 13	24	32	16	0	8	0	TG6000	WELL 13	13
17	W14	WELL 14	24	32	16	0	8	0	TG6000	WELL 14	14
18	W15	WELL15	24	32	16	0	8	0	TG6000	WELL15	15
19	W16	WELL 16	24	32	16	0	8	0	TG6000	WELL 16	16
20	W17	WELL 17	24	32	16	0	8	0	TG6000	WELL 17	17
21	W18	WELL 18	24	32	16	0	8	0	TG6000	WELL 18	18
22	W19	WELL 19	24	32	16	0	8	0	TG6000	WELL 19	19
23	W20	WELL 20	24	32	16	0	8	0	TG6000	WELL 20	20
24	W21	WELL 21	24	32	16	0	8	0	TG6000	WELL 21	21
25	W22	WELL 22	24	32	16	0	8	0	TG6000	WELL 22	22
26	W23	WELL 23	24	32	16	0	8	0	TG6000	WELL 23	23
27	W24	WELL 24	24	32	16	0	0	0	TG6000	WELL 24	24
28	IS1	INDUSTRIAL SUB. 60KV	56	208	16	0	40	0	TG6000	INDUSTRIAL	1
29	G2	N.C.P.A. GEN. SITE	24	16	16	0	0	0	TG6000	MCLANE	4
30	SL	SACRAMENTO LIFT	24	32	16	0	0	0	TG6000	SACRAMENTO LIFT	16

31	PB	PETERSON BASIN	24	32	16	0	0	0	TG6000	PETERSON BASIN LIFT	1
32	WLL	WOODLAKE LIFT	24	32	16	0	0	0	TG6000	WOODLAKE LIFT	4
33	CAB	CLUFF AVE. BASIN	24	32	16	0	0	0	TG6000	CLUFF AVE. BASIN	2
34	SB	SALAS BASIN	24	32	16	0	0	0	TG6000	SALAS BASIN	3
35	VWB	VINEWOOD BASIN	24	32	16	0	0	0	TG6000	VINEWOOD BASIN	5
36	LLB	LODI LAKE BASIN	24	32	16	0	0	0	TG6000	LODI LAKE BASIN	6
37	KFB	KOFU BASIN	24	32	16	0	0	0	TG6000	KOFU BASIN	7
38	NEL	NORTHEAST LIFT	24	32	16	0	0	0	TG6000	NORTHEAST LIFT	13
39	ML	MOKELUMNE LIFT	24	32	16	0	0	0	TG6000	MOKELUMNE LIFT	14
40	RGL	RIVERGATE LIFT	24	32	16	0	0	0	TG6000	RIVERGATE LIFT	15
41	GM	GENERAL MILLS INDUSTRIAL SUB	24	32	16	0	0	0	TG6000	GENERAL MILLS SUB.	32
42	IS2	12KV	64	96	16	0	56	0	TG6000	INDUSTRIAL	2
43	TDL	TIENDA DRIVE LIFT	24	16	16	0	0	0	TG6000	TIENDA DRIVE LIFT	17
44	W25	WELL 25	24	32	16	0	8	0	TG6000	WELL 25	25
45	TOW	TOWER	24	32	16	0	0	0	TG6000	TOWER	2
46	ALR	ALARM RTU - BACK ROOM	24	80	16	0	32	0	TG6000	ALARM RTU	1
47	TRU	TURNER RD. UNDERPASS	24	32	16	0	0	0	TG6000	TURNER BASIN	8
48	W26	WELL 26	24	32	16	0	8	0	TG6000	WELL 26	26
49		WELL 28	24	32	16	0	8	0	TG6000	WELL 28	28
	Total		1392	2016	784	0	496	8			
51	WEA	WEATHER	24	16	16	0	0	0		SPARE 8	58
52	SUP	SUPPORT RTUS	24	16	16	0	0	0		HENNING	60
53		PUMP SUPPORT	24	16	16	0	0	0		SPARE 8	62
55	COM	COMM. RTU	24	16	16	0	0	0		SPARE 8	54
56		STORM PUMP	24	16	16	0	0	8		SPARE 8	56
57	TAL	TEMP. ALARM RTU	24	80	16	0	8	0		SPARE 7	26
58	TSR	TRAINING SUB.	24	16	16	0	0	0		SPARE 8	52

CITY COUNCIL

BOB JOHNSON, Mayor
JOANNE MOUNCE,
Mayor Pro Tempore
LARRY D. HANSEN
SUSAN HITCHCOCK
PHIL KATZAKIAN

CITY OF LODI

ELECTRIC UTILITY DEPARTMENT

GEORGE F. MORROW, DIRECTOR

1331 S HAM LANE

LODI, CALIFORNIA 95242-3995

(209) 333-6762

FAX (209) 333-6839

BLAIR KING, City Manager

RANDI JOHL, City Clerk

D. STEPHEN SCHWABAUER,
City Attorney

October 23, 2007

To Prospective Bidders

Subject: **Request for Proposal (RFP) to replace and upgrade the existing Supervisory Control and Data Acquisition (SCADA) System for the Water, Wastewater and Power Distribution Systems**

The City of Lodi (City) hereby invites sealed proposals to provide services to design and build a comprehensive system to replace and upgrade the existing SCADA. Each bid shall be in accordance with this notice and specifications on file and available from the Engineering and Operations Manager, City of Lodi Electric Utility Department, 1331 South Ham Lane, Lodi, California 95242, (209) 333-6811. No bid will be considered unless it is submitted on a format according to the 'ORGANIZATION OF PROPOSAL' Section of this RFP document.

Sealed proposals shall be delivered to the Budget Manager – Finance Department at the City Hall Annex, 300 West Pine Street, Lodi, CA 95240 (P.O. Box 3006, Lodi, CA 95241-1910) on or before

November 28, 2007, Wednesday at 11:00 a.m.

At that date and hour said sealed proposals will be publicly opened and read in the Public Works Conference Room, City Hall, 221 West Pine Street, Lodi, California. Bidders or their authorized representatives are invited to be present.

Please submit detailed proposal. If there are any questions regarding this request for proposal, you may contact Mr. Abel Palacio, Sr. at (209) 333-6809, or by email to ahpalacio@lodielectric.com.

Demy Bucaneg, Jr. -PE
Manager, Engineering & Operations Division
Tel. No. (209) 333-6811
Email: dbucaneg@lodielectric.com

BACKGROUND

The current SCADA Systems of the City is based on the Siemens Telgyr 8500 System. It is a 1984 technology and is no longer supported by Siemens or any third party vendors. Multiple failures and the inability to obtain spare parts and software have made it difficult to operate the water, wastewater and power distribution utilities efficiently and economically. The existing SCADA System monitors and controls the water well pumping sequence. The water well and booster pump system provides a systematic rotation of the water well pumps and pressure equalization in the system. Another function of the SCADA system includes the sewage treatment lift station well monitoring, alarm acknowledgement and flow status. In addition, the SCADA also provides monitoring of the storm station status as well as alarms. Finally, the SCADA system provides monitoring and direct control of the power grid system in the City's electric transmission and distribution system. The communication network used to interface the SCADA computer to the remote station are leased telephone lines from the local Telephone Company. The existing SCADA system uses communication ports to connect to those leased lines via T202 modems to Remote Terminal Units (RTU) at each respective location. This RFP requires the selected contractor to utilize the existing communications lines and RTU's in their proposal.

At present, the City has two (2) SCADA Systems with each system having a duplicate unit designed to operate in parallel for redundancy. The first system was placed in operation in the 1980s utilizing its System B unit and has been operating with several failures experienced in a monthly basis. Its System A is currently inoperable for quite a long time now. Attempts to make it work proved challenging due non-availability of parts and issues of failing the entire first SCADA System whenever it was connected on line. The System B is still being utilized by operations and appeared to be the most reliable unit. This first system is a Siemens product.

The existing second system is also supplied by Siemens. It was awarded in mid-2001 with the approach that City personnel will do in-house programming for the control and monitor of the water, wastewater and power operations. The basic SCADA framework and softwares were configured and integrated by Siemens. This second system was partly operational in its monitoring functions and provided unreliable values. Both System A and B units were never put into full operation until now. This SCADA System was also infected with virus. Its hardware and software features were determined to be obsolete with today's technology that required replacement and updating.

The SCADA System is vital to the operation of the City's utilities that needs immediate implementation. The replacement and upgraded SCADA shall include but not limited to the following monitor and control functions:

- Comply with City of Lodi RFP and Exhibit 1 - Specifications
- (4) Electrical Substations, and accompanied transmission and distribution Control of PCB (primary circuit breakers) load changers (LTC), re-closure function. Monitor voltage, current, KVA, KW, PF, and various digital and analog signals
- (27) Water wells and booster pump control and monitoring with auto failure over during communication failure of SCADA. Monitors system pressure, flow, levels, alarms etc.
- (6) Wastewater lift station monitor of sump levels, pump status, emergency gen-set, alarms, etc.
- (8) Storm station levels, flow pump status, alarms etc
- (1) Co-Generation system, monitor conditions, power etc.

SCOPE OF WORK

The scope of work shall include all the requirements as stipulated in the 'Exhibit 1 – Specifications' and other requirements as stated in this RFP and also the items below.

- Provide dual SCADA servers, dual SCADA host with 2 monitors each 21" for total of 4 monitors and other associated hardware, Dual 64 channel communications boards (connect to existing T202 modems), (1) new web server. All devices shall be rack mounted.
- All associated software. Windows Server 2003, Windows XP, Microsoft office 2003 SCADA software, Telgyr 6000 and DNP 3.0 protocol drivers, SCADA alarm, (5) custom script applications based on flow charts provided by the City.
- Migration of existing database and screens. Or build new from scratch with COL assistance.
- Selected bidder shall field verify all connections, communication lines and protocol's used by City of Lodi telemetry system.

ORGANIZATION OF PROPOSAL

Prospective Bidders are furnished with one request for proposal (RFP) document and the Exhibit 1 - Specifications. Proposals shall follow the following format:

- A. Project approach narrative – This section should demonstrate an understanding of the task at hand and include a narrative describing how the Bidder would go about the work.
- B. Project team – Describe the personnel who will carry out project tasks, and their respective responsibilities.
- C. Qualifications – Provide curricula vitae for all personnel on the project team and a narrative describing how the team as a whole meets the qualifications for the project. Include a list of prior relevant work or projects. Include in this section the information being solicited in the 'Exhibit 1 – Specifications, Bidder Requirements' as part of the bid proposal.
- D. Workplan – This section should include an allocation of time to the work to be accomplished and an indication of who will carry out which tasks. Include in this section the information being solicited in the 'Exhibit 1 – Specifications, Bidder's Responsibilities' as part of the bid proposal.
- E. Exceptions and Clarifications – This section shall include a summary of all the exceptions and clarifications with references to specific paragraph and/or section of the specifications.
- F. Budget – This section should consist of a bid including hourly rates and an overall contract price for the scope of work specified.
- G. Time – The bid proposal shall include detailed project schedule. The replacement and upgraded SCADA System shall be completed, tested, commissioned and fully operational in six (6) months from the date of contract execution and/or Notice to Proceed.
- H. Signatures - The proposal must be signed with the full name and address of the bidder, by an authorized representative of the company with all the information below.

- i. Name of company
- ii. Address
- iii. Authorized signature
- iv. Name
- v. Title
- vi. Telephone No.
- vii. Fax No.
- viii. Date

- I. Note - The City of Lodi reserves the right to reject any or all bids, to waive any informality in any bid, to accept other than the lowest bid, or not to award the bid.

PROPOSAL SUBMISSION

- A. The Budget Manager –Finance Department will receive sealed proposals at the following address until

11:00am, Wednesday, November 28, 2007.

- B. Proposals shall be submitted under sealed cover, plainly marked

Proposal – Lodi Electric Utility SCADA System Bid Opening - November 28, 2007.

Bids which are not properly identified may be disregarded. Bids, which are not received by 11:00am, Wednesday, November 28, 2007 will be returned to the bidder unopened.

Bids shall be submitted

To: Lodi City Council
c/o Budget Manager –Finance Department

(If delivered by FedEx, UPS, or courier): (If delivered by mail):
300 West Pine Street P O Box 3006
Lodi CA 95240 Lodi CA 95241-1910

BID OPENING

- A. At 11:00AM, Wednesday, November 28, 2007, or as soon as possible thereafter, in the Public Works Conference Room, City Hall, 221 West Pine Street, Lodi, California, proposals will be publicly opened and read. Bidders or their authorized representatives are invited to be present.

SELECTION PROCESS

Proposals will be reviewed by the Utility Operations Supervisor, Senior Power Engineer, the Engineering & Operations Manager and the Electric Utility Director. Complete proposals will be evaluated based on the information submitted. This will permit a recommendation to the City Council for contract award. The following equally weighted criteria will be used to evaluate submitted proposals:

- A. The likelihood of the proposed approach to produce the desired results.

- B. Qualifications of the Bidder.
- C. The value offered by the Bidder's price in relation to the proposed approach.

REJECTION OF PROPOSALS

The City of Lodi Electric Utility Department reserves the right to reject any and all proposals and to solicit new proposals with modified terms and conditions. It also reserves the right to waive any informality in connection with the proposals.

CONTRACT AWARD

1. The City of Lodi reserves the right to reject any or all bids, to waive any informality in any bid, to accept other than the lowest bid, or not to award the bid.
2. If there will be a tie in the submitted proposals, the tie will be broken by a coin toss, conducted by the Budget Manager –Finance Department. Tie bidders will be notified and may be present.
3. Where alternative bids are received, the City Council reserves the right to select the bid most advantageous to the City.
4. The award, if made, will be made within forty-five (45) days after the opening of the bids.
5. The bid proposal as submitted by the selected bidder, the SCADA RFP and the Exhibit 1 – Specifications shall be the supporting documents and considered as parts of the contract.

GENERAL PROVISIONS

5-409 Responsibility for Damage The City of Lodi, its elected and appointed boards, commissions, officers, agents and employees shall not accept responsibility for any loss or damages that occur during the scope of work to the work or any part thereof; or for any material or equipment used in performing the work; or for injury or damage to any person or persons, either work personnel or the public; for damage to adjoining property arising from or related to Contractor's negligence or willful misconduct during the progress of the work or any time before final acceptance.

The Contractor shall indemnify and save harmless the City of Lodi, its elected and appointed boards, commissions, officers, agents and employees from any suits, claims or actions brought by any person or persons for or on account of any injuries or damages sustained or arising out of Contractor's negligent acts, errors or omissions in the performance of the work or in consequence thereof. The City of Lodi may retain as much of the money due the Contractor as shall be considered necessary until disposition has been made of such suits or claims for damages as aforesaid.

5-413 Insurance Requirements for Contractor The Contractor shall provide proof of insurance to be maintained during the life of this contract as listed under General Liability and Automobile Liability coverage listed below. These insurance policies shall protect the Contractor and any subcontractor performing work covered by this contract from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which

may arise from Contractor's operations under this contract, whether such operations be by Contractor or by any subcontractor or by anyone directly or indirectly employed by either of them, and the amount of such insurance shall be as follows:

- | | |
|----------------------------------------|----------------------------------------------|
| 1. <u>COMMERCIAL GENERAL LIABILITY</u> | 2. <u>COMPREHENSIVE AUTOMOBILE LIABILITY</u> |
| Per Occurrence | \$1,000,000 Combined Single Limits |
| \$1,000,000 Property Damage | |
| Personal & Adv Injury | |
| \$2,000,000 General Aggregate | |

NOTE: Contractor agrees and stipulates that any insurance coverage provided to the City of Lodi shall provide for a claims period following termination of coverage, which is at least consistent with the claims period, or statutes of limitations found in the California Tort Claims Act (California Government Code Section§ 810 et seq.).

A copy of the certificate of insurance with the following endorsements shall be furnished to the City of Lodi:

(a) Additional Named Insured Endorsement with Primary Wording

Such insurance as is afforded by this policy shall also apply to the City of Lodi, its elected and appointed Boards, Commissions, Officers, Agents and Employees as additional named insured, insofar as work performed by the insured under written contract with the City of Lodi.

(This endorsement shall be on a form furnished to the City of Lodi and shall be included with Contractor's policies.)

Wording: Such insurance as is afforded by the endorsement for the Additional Insureds shall apply as primary insurance. Any other insurance maintained by the City of Lodi or its officers and employees shall be excess only and not contributing with the insurance afforded by this endorsement.

(c) Severability of Interest Clause

The term "insured" is used severally and not collectively, but the inclusion herein of more than one insured shall not operate to increase the limit of the company's liability.

(d) Notice of Cancellation or Change in Coverage Endorsement

This policy may not be canceled nor the coverage reduced by the company without 30 days' prior written notice of such cancellation or reduction in coverage to the City Attorney, City of Lodi, P.O. Box 3006, Lodi, CA 95241.

(e) Contractor agrees and stipulates that any insurance coverage provided to the City of Lodi shall provide for a claims period following termination of coverage, which is at least consistent with the claims period, or statutes of limitations found in the California Tort Claims Act (California Government Code Section 810 et seq.).

"Claims made" coverage requiring the insureds to give notice of any potential liability during a time period shorter than that found in the Tort Claims Act shall be unacceptable.

5-414 Workers' Compensation Insurance The Contractor shall provide proof of and maintain during the life of this contract, Worker's Compensation Insurance for all Contractor's employees employed at the site of the project and, if any work is Subcontracted, Contractor shall require the subcontractor similarly to provide Worker's Compensation Insurance for all of the latter's employees unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this contract at the

site of the project is not protected under the Worker's Compensation Statute, the Contractor shall provide and shall cause each subcontractor to provide insurance for the protection of said employees. This policy may not be canceled nor the coverage reduced by the company without 30 days' prior written notice of such cancellation or reduction in coverage to the City Attorney, City of Lodi, P.O. Box 3006, Lodi, CA 95241.